

ON THE TREATMENT OF TRAUMATIC ANEURISMS, WITH REPORT OF A CURED CASE  
OF TRAUMATIC ANEURISM OF  
THE RIGHT COMMON CAROTID ARTERY.

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CASE. On April 21, 1887, Pauline Chruscikowska, æt. 41, came to my department, sent by a doctor from Volhynia. The woman was very feeble and pale, with suffering imprinted on her countenance, and thus described the beginning of her illness: About two years ago she noticed that the right half of her neck was rather thicker than the left. In the parts below the angle of the jaw she could, on palpation, feel a tumor as large as a plum, which gradually enlarged and had this year attained the size of a hen's egg, without, however, causing any pain. This tumor did not alter as to size, but the patient imagined that it appeared rather larger of a morning, or after she had been walking more than usually in the course of the day. It was not very deeply situated; could be grasped between the fingers anteriorly. Under pressure it receded. The patient felt no pulsation during this examination. The constant growth of the tumor and frequent nausea induced her to seek medical advice. Four weeks previous she went to a doctor, who first punctured the tumor with a glass syringe, (probably that of Pravaz) and then (it may be that the needle had not reached the tumor), made an incision with a knife and introducing the same syringe into the wound, drew off from the tumor, 15 syringefuls of a transparent light yellow fluid. He then injected into the cavity a yellow solution (probably iodine or perchloride of iron), dressed the wound and sent away the patient to her home, several miles away.<sup>1</sup>

<sup>1</sup>As I see from the letter of my colleague, the injected fluid was a 10% solution of zincum muriaticum. Dr. R. says distinctly that he had to do with a cystis colloidea, and injected the fluid for the purpose of bringing about adhesive inflammation.

While yet on her way she experienced a feeling of numbness at the nape of the neck, and a slight pinching in the parts round the late tumor. On the next day the pain increased and fever set in, so that she was confined to bed for four days. On the eighth day after the above-mentioned puncture, the patient, tired with her day's work, suddenly felt a violent tearing pain and pulsation in the neck. Wishing to relieve the pain she took off the bandage and then remarked a much larger tumor, which not only filled the place of the former one, but descended lower on the neck. Another doctor being summoned, supposing that inflammation had set in, punctured the tumor with a syringe and drew off pure blood; he remarked that it had not yet come to suppuration and advised compresses. As the pains and the tumor continued to increase, while the patient at times had the sensation as if something in her neck had suddenly burst, accompanied by violent pain and enlarging of the tumor, which at the same time became uneven (irregular on the surface), a consultation was arranged.

During this consultation the tumor was punctured with a knife, but instantly the blood gushed out, so that the wound had to be sutured as quickly as possible and covered with hæmostatic cotton-wool, the tumor was covered with cotton-wool saturated with collodion, and thus a shield was formed, which adhered rigidly to the skin and restrained the growth of the tumor. The patient was then sent to Warsaw. The tumor now enlarged, not daily, but hourly; at times there was a pain as of tearing and bursting in the neck, besides retraction of the tongue and piercing pain in the right half of the head and nape of the neck.

On April 22, after removing the shell of cotton-wool and collodion, we found as follows: The patient can only with difficulty change her position from sitting to lying and *vice versa*; to restrain the pain she often catches on her head, supporting it with her hands. The head is turned with the face to the left and slightly bent downward. The whole part on the right side of the neck is occupied by a very prominent tumor along the sterno-mastoid muscle, extending from the mastoid process and the jaw nearly to the right clavicle, which, however it does not reach, being separated from it by a free space of the width of a finger. At the back, the tumor reaches the line drawn from the mastoid process to the middle of the clavicle, and at the front it almost reaches the center line of the neck, displacing the larynx and the trachea toward the left. The skin on the tumor is partly pink, in some places the epidermis is raised in blisters (bullæ) or even desquamating under the influence of the collodion or some other irritant, and

in some places there may be seen shining through, pale blueish marks as of a bruise. At about the apex of the carotid triangle is a horizontal scar of about three-fourths centimeter in length, and lower down, the sutured small wound, closed up by the hæmostatic cotton-wool. On close observation the pulsation of the tumor becomes visible; it may be distinctly felt by the fingers and made more apparent still by the stethoscope, and is simultaneous with the pulse. Taking the tumor between the fingers, it can be felt to pulsate synchronously with the heart. A slight puffing (blowing) bruit murmur which corresponds with the diastole of the arteries can be heard on auscultation. The tumor itself is elastic, especially in the center, which is its most prominent part; it is firmer at its periphery. Its margin is not very distinctly defined, owing to the infiltration of tissues which conceal the borders of the healthy parts; the tumor is not moveable. Under pressure, which from consideration for the patient is not very great, it diminishes but slightly. The examination of the tumor is not painful, with the exception of soreness of the skin, where it has been denuded of epidermis. The veins of the neck, face and temples are not distinct, not dilated (distended). Pulsation in the artero-temporalis on both sides is synchronous, with no difference in force. Pulsation in the radial artery *considerably weaker* than in the left. The patient feels no permanent pain in the head or ringing in the ears. The right fissura palpebrarum is permanently narrower than the left, the eyelid seeming to droop. The pupils are equal in size, but the right expands more indolently than the left. The jaws open only so far as to admit a finger; examination of the pharyngeal cavity, therefore, does not succeed. Deglutition quite easy. respiration not oppressed, voice unchanged, no cough or expectoration. The skin of the face is slightly cyanotic, veined on the nose, cool and damp on the nose and forehead.

The heart tones quite clear and distinct, beating strong, 100 in the minute. Temperature normal. Respiration of the chest vesicular. Further, no considerable changes have been remarked. The tumor was covered with iodoform gauze which was fastened down firmly by strips of adhesive plaster with the view of making the pressure equal.

After having considered the history and the results of the examination, we arrived at the following conclusions: The patient must have had some kind of cyst in the parts below the jaw, not a congenital cyst, probably situated in the vicinity of the division of the carotid artery. That it was a cyst and not an aneurism was evident from the fact that the doctor after the exploratory puncture, had made an incision and drawn off 15 syringefuls of fluid, then dressed the wound and sent the

patient home. Most probably, in consequence of the injection of an irritating fluid into the cavity, which was in immediate connection with the wall of the artery, and at the same time owing to the diminished pressure caused by the emptying of the cyst, the wall of the artery burst and the blood gushed in, first into the cavity of the late cyst, and from thence breaking through into the tissues, formed an enormous cavity filled with blood flowing freely from the lumen of the artery to the tumor, the proof of which was the puffing (blowing) bruit. In this manner a traumatic aneurism had been found.

In default of a great many characteristic symptoms: (venous distention of subcutaneous veins, so called *fremissement vibratoire* or thrill, which can be felt by the fingers, the puffing bruit, constant und in creasing in force, synchronous with the diastole of the artery, (*bruit de souffle*), venous pulsation and so on, the idea of an arterio-venous aneurism could with certainty be excluded.

Now came the important question: what was to be done with the patient? Considering the rapid development of the tumor, the pressing back and laceration of tissues, the approaching fatal moment of the bursting of the aneurism, I at once could see only *one* way of deliverance; instead of awaiting the hæmorrhage, rather to avert it in this manner: to make a rapid, bold and wide incision from the apex to the base of the tumor, instantly press down with the finger the opening in the artery, remove the blood and coagulum from the cavity and then ligature the vessel. I could with terrible clearness see all the danger of this proceeding, seldom resorted to in connection with the small arteries of the extremities, but on the other hand there was the inevitable alternative of death by hæmorrhage, ignominious in the face of the improvements of our modern surgery.

The state of the patient meanwhile had become much worse during 48 hours; disturbances in deglutition and respiration had set in owing to the pressure on the trachea and œsophagus, the larynx was pressed down still further, the jaws so closed that a finger could not be introduced into the pharynx, debility great, and the pain and fear of increased pain so great, that the patient entreats not to be touched or her bandages removed. On removing the latter we found as follows:

The tumor had enlarged very considerably, the distance from the attachment of the lobe of the ear to the sternal attachment of the sterno-cleido-mastoidei muscle being 18 centimeters. The tumor had moved mostly downward, reaching the clavicle, so that the ligature of the common carotid artery of which I had thought as the introduction to the above mentioned operation had evidently become impossible.

On examining the cavity of the mouth with the finger, one can distinctly feel the floor of it raised at the right side, and one can also see the right arch projecting towards the median line of the body. The skin on the aneurism is more cyanotic than before and feels distinctly cooler than the skin on the left side of the neck, so that the bursting of the sac and gangrene of the skin with all its horrors, seem imminent. The tumor is very much firmer in consequence of the partial filling of the sac with coagulum, but nevertheless the rhythmic motion of the expansion simultaneous with the systole of the heart and the puffing (blowing) bruit, are quite distinct. The colleagues whom I had invited to consultation agreed that the only way was in opening the sac by a bold incision to come to the bottom (fundus) of it, there press down the common carotid artery, and having found the opening in the vessel, which to judge from the position of the cyst ought to be rather high up in the region of the division, there put on the ligature. The preceding ligature of the common carotid artery between the sac and the clavicle of which I had at first thought, had become impossible by the spreading of the aneurism to the clavicle.

On the same day about 12 o'clock with efficient aid. After having put the patient under chloroform, cleansed the neck as thoroughly as possible with soap, ether and solution of sublimate, I made a rapid, long incision from the apex to the base, and having removed a quantity of coagulum with fingers and sponge I introduced a finger into the cavity, at the bottom of which I felt the pulsation of the common carotid artery. I pressed down the latter, but seeing that arterial blood continued to flow from the upper part of the cavity, I on chance, put my finger on the point from which the blood gushed out, pressing it against the vertebræ. After I had in this manner stopped the hæmorrhage, my colleague Tawdyriski made two horizontal incisions, and we then cleansed the walls of the cavity with a sponge and washed it out with solution of sublimate. Now we could see the common carotid artery traversing the bottom of an enormous cavity. I seized the artery just below the compressing fingers with a very powerful forceps used for adhesions of ovarian cysts. As soon however, as I had removed the fingers the blood gushed out again, and again the bleeding vessel had to be seized by another forceps, two other bleeding points quite near being secured by the small forceps of Spencer Wells. In this way we mastered the hæmorrhage and having washed out the cavity, could examine its walls carefully. The exposed common carotid artery evident by its whiteness by its pulsation, traverses the posterior wall of the cavity; the internal jugular vein is not distinguishable. In the

upper part of the bottom of the cavity one can see the bifurcation of the artery, the actual seat of the hæmorrhage which had been caused by the sundering of the external carotid artery from the trunk of the common carotid artery. There were two other bleeding points, it may be the thyroidea superior artery and the pharyngea ascendens artery as those which have their origin nearest the bifurcation. The further course of the carotidis in interna et externa artery is concealed by tissues infiltrated with blood, but they have also no accompanying veins visible. Higher up, in the parts near the under jaw, one sees a dark red bunch, which may be supposed to be the digastric muscle of the jaw, as also a dark red projection which is the sub-maxillary salivary gland. In the parts near the bifurcation, especially inwards from the carotid externa artery which had been seized by the forceps, one remarks a smooth membranous tissue resembling the walls of a sebaceous cyst after its contents had been scraped out, or the inner membrane of arteries, which can be easily separated from the deeper parts below it.

This membrane, pieces of which I took for microscopic examination, probably formed the inner layer of the cyst into which the blood had broken through and then distended it. Finally, the inner surface of the aneurism, especially on the front wall (which had been cut through) is uneven, divided up by numerous trabeculæ like the interior of the right heart. The surface of these trabeculæ, and of the oblong grooves between them, is smooth, almost glistening. This surface was covered by a thick layer of coagulum, which could however be easily removed by the sponge and fingers.

At about 2 to 3 centimeter's distance from the lesion of the vessel, I ligatured the common carotid artery with coarse silk, passed in by the needle of Dechamps, and then removed the forceps which secured the common carotid artery. When I now removed the forceps from the external carotid artery the blood gushed out with as much force as if the common carotid artery had never been ligatured. For this reason the external carotid artery and the internal carotid artery, above the bifurcation and two other smaller bleeding vessels, were ligatured. After the most careful washing out of the cavity with a 3% solution of phenol and 1% solution of sublimate, I sutured the horizontal incision entirely, and the perpendicular from the apex and from the base so as to leave in the middle a fairly large opening for the discharge of a possible exudate. For the same purpose I made a counter opening posteriorly on the margin of the trapezius muscle. The dressing consisted of silk protective, iodoform gauze fastened down by strips of adhesive plaster, then hygroscopic cotton wool fastened down by a bandage of calico,

and above that a pad of sawdust, which surrounds the nape of the neck part of the side head and the upper part of the chest.

The patient meanwhile had recovered consciousness, and declared all her former pains had ceased, in consequence of which she felt very well notwithstanding the operation which had just taken place.

*De cursu morbi.*—The next day after the operation we found entire paralysis of the left half of the body, the nose deviating to the right, the corners of the mouth drawn in the same direction, left sulcus nasolabialis and the wrinkles on the left half of the chin smoothed away, the lids of the left eye close well, the right fissura palpebrarum narrow, the eyelid as if swollen, complete anæsthesia and paralysis of the muscles of the left upper and lower extremities, and the left half of the body; the skin and tendon reflexes much stronger; these extremities somewhat swollen.

As to the intelligence of the patient one may say that it has been preserved, but impaired; she does not know that she is paralysed, takes little interest in her surroundings, falls off her pillows and lies with her eyes half-closed. Although she answers questions reasonably enough, she does not realize what has happened, wishes to sit up, to bathe, calls a certain Michael, who is a man-servant in the part of the country from which the patient has come. She drinks willingly, and with great pleasure smokes cigarettes, to which she was habitually addicted; but she easily chokes and begs to be allowed to drink in a sitting posture, in which liquids do certainly much more easily pass down into the stomach.

April 25, evening. Skin warm, warmer than in a healthy person; temperature in the axilla, nevertheless, normal; pulse even much stronger, 130 in the minute.

April 26, morning. Pulse 100, stronger in both radial arteries; general state unchanged; urine had to be drawn off. In the evening, pulse 98.

April 27, morning. Pulse, 96. During the night patient had been quiet; drinks very readily, sitting.

May 1. In the morning patient micturated in bed; complains of pain in the right half of the head, otherwise, lies quietly on her back, with the head turned to the left. Both fissuræ palpebrarum almost equal (while up till this time, the right had been constantly narrower than the left). As to intelligence and consciousness, they are still only partial; the patient answers questions reasonably enough, but almost invariably repeats words; for instance—"does your head ache?" "Aches, aches," and so on. She recognizes persons, but at the same time

takes somebody for a priest, or one person for another, and when she sees both at once does not seem to realize her mistake. She suffers from constipation—has no decubitus.

It would be both tedious and superfluous to describe the state of the patient day by day, as noted by the hospital cards. I shall, therefore, only mention the most important points.

In the first place we, from the very beginning, treated the patient with every possible care and attention; urine was drawn off by the catheter, or if the patient micturated in bed, she was instantly removed to a dry bed; every few days injection of the rectum with warm water was made for the purpose of evacuation, the skin of the back and posterior was rubbed with the hand, diet very carefully attended to; in one word, everything which might prove hurtful was carefully considered and avoided.

As the upper layers of the dressing were often wetted by liquids, spilled in drinking, they were changed as often as necessary, without, however, the deeper layers being touched. On the seventh day the sutures were removed, the wound found quite healed, with the exception of the opening which had been left, and which was filled with dark red coagulum. The whole part of the skin which, before the operation, had been bluish, and here and there denuded of epidermis, had now quite come to itself, so that only its yellowy-greenish coloring testified to past ecchymosis of blood. Toward the end of the second week, the patient became very restless, and tore out pieces of cotton wool from under the bandage. I, then, for the safety of the wound, put on for a certain time a dressing of gypsum on the neck, nape of the neck, and the parts around the jaw and clavicle, for the purpose of securing the dressing of the wound from the fingers of the patient. In the beginning of the fifth week, the wound was entirely healed, without one drop of pus, or falling out of the ligatures.

About this time the patient began to regain the sense of feeling, and at the end of the sixth week, motion, so that she could with aid, walk up and down the ward. Our fears of inflammation of the bronchiæ or lungs, in consequence of particles of food getting into the respiratory ways, proved unfounded; there was also no decubitus. The temperature of the patient had all this time never exceeded  $37.8^{\circ}$  C. On the day on which I reported this remarkable case to the Warsaw Medical Association, June 7, 1887, that is, 44 days after the operation, the state of the patient was as follows:

Face white and full, the head while lying usually turned to the left, and in general, the patient prefers lying on the left side. The right

fissura palpebrarum wider than the left, especially when speaking or whistling, distinctly paralyzed, the upper extremity also completely paralyzed, fingers bent; can, however, be easily straightened. While lying on her back, the patient can neither lift nor bend her right leg; in trying to bend the extremity passively, in the knee one can feel resistance (contracture) which is easily overcome; the patient can herself straighten the bent leg, during which the hand, holding the skin and resisting the bending, can distinctly feel the action of the straightening muscles. The patient can turn herself in bed, can sit alone, and with aid, walk about the room. Putting out of the tongue is still difficult. There are no disturbances in the respiratory, circulating and digestive organs. The patient feels the desire to micturate, and does so into the chamber pot, and not in her bed. On the neck there is a deep indentation, at the bottom of which one can see a reddish-blue scar. In the lower part of the right common carotid artery one can feel very slight pulsation. If the patient chokes while eating, she sometimes feels a pain in the side of the neck, below the right angle of the jaw and ear. Finally, her intelligence, excepting a certain disposition to sadness, does not seem impaired. She speaks distinctly, answers reasonably, knows that she has a paralyzed arm, reads letters from her family and takes an interest in it; makes reasonable requests (as to a bath, certain articles of food, etc.).

The patient left the hospital on July 14, 1887, with partial paralysis of the upper extremity, but she could, though with some difficulty, walk alone, and move the upper extremity fairly well.

#### REMARKS.

Having finished the description of the case, I now pass on to some remarks upon it, which have been suggested to me by the study of the literature bearing on this subject. I shall chiefly confine myself to aneurisms of carotid arteries, passing over aneurisms of other parts.

1. In the first place, the hemiplegia sinistra, arising within the first twelve hours after the operation, is most worthy of attention. In our case, as the paralysis came on in the night, the state of the patient preceding the appearance of the hemiplegia had not been remarked, it is unknown whether there were convulsions, spasms, etc.—the following morning we only noticed much stronger reflexes of the skin and tendons. Cer-

cerebral complications, after ligature of the carotid artery, have long been known, and have been the subject of many researches, both experimental and clinical. There is, nevertheless, no certain theory explanatory of the various cerebral disturbances, and as our case shows no new features, we pass it over, only remarking that these disturbances are the most serious complication subsequent to ligature of the common carotid artery. Lefort, after analyzing the various aspects of the question, thus concludes: "It is remarkable that, even after excepting cases of ligature of both common carotids, cases in which disease of the brain existed before the operation, and finally cases in which the subclavian artery was ligatured, as well as the carotid, out of 370 cases, 100 cases of cerebral disturbances have been noted, that is, above one-fourth of cases. Death in consequence of said disturbances took place in 78 cases; which proves that of 370 cases, 78, or one-fifth of the deaths, were caused by cerebral disturbances. But this is not yet all; if we put aside, not to confuse our deductions, those cases in which both common carotid arteries have been ligatured, and further, those in which the artery was ligatured in consequence of nervous symptoms, or to facilitate another operation, cases, therefore, in which the mortality peculiar to the operation itself is added to the mortality incidental to ligature, we have yet left 302 cases, in which there are 170 cases of recovery and 132 cases of death. The mortality after ligature is, therefore, high—exceeds 43 in 100. Of the 132 fatal cases, 73 deaths were caused by cerebral disturbances; so that, if this powerful cause of failure could be removed, the mortality would fall from 43% to 19%. Hence the conclusion: the frequency of cerebral complications consequent on the closure of the trunk of the carotid artery is the chief danger attending ligature of *arteria carotis communis*.<sup>2</sup> According to Pilz<sup>3</sup>, cerebral symptoms appear in 32% of cases, while Reis, his continuator, having recorded 73 cases of ligature of *arteria carotis communis* in antiseptic times, notes 17 cases of cerebral symptoms=23%.<sup>4</sup>

<sup>2</sup>Dictionnaire encyclopédique des sciences médicales; art. "carotide."

<sup>3</sup>Lehrbuch der speciellen Chirurgie von Koenig. T. I., p. 506.

<sup>4</sup>Ueber die nach Unterbindung der *Arteria carotis communis* vorkommende Gehirnerscheinungen. Inaugural Dis., Würzburg. Jahreshesicht von Virchow und Thiersch für das Jahr 1885.

## MODE OF ORIGIN OF THE ANEURISM.

2. One of the most interesting features of the case related is the mode of origin of the aneurism. There is no doubt, after what had been told by the patient and the letter of her doctor to me, that, in the given case, there existed, in the region of the division of the common carotid artery, a cyst, with colloid contents, and that the aneurism arose in consequence of the weakening of the arterial wall, partly under the action of chloride of zinc, in the course of several hours after the operation. The patient had already, on her way home, felt violent pain in the nape of the neck; taking for granted that this pain was in the beginning caused by the action of the solution, the subsequent shooting pains and distension in the neck testify to the bursting of the arterial wall and the overflow of blood. Prof. Kosinski, in conversation with me, expressed the hypothesis that the cyst must have been in the wall itself of the artery, basing his theory on the rapid bursting of the artery. Certainly the rapid action of the solution, which, after all, was not very strong, seems to favor this explanation, although on the other hand, pathological anatomy scarcely admits the existence of cysts in the walls of the arteries. Having this point in view, I extracted from the posterior wall of the aneurism, at about the height of the division, a membrane, which Dr. Przewoski has been kind enough to examine under the microscope. The results of the examination he gives as follows:

"The membrane presented to me for the purpose of examination is of the thickness of 1 to 1½ mm., hard, very compact, on the inner surface rather smooth, passing into looser tissue on the outside; from the slips taken from different places, it appears that the membrane is everywhere of the same structure; thus, on the outside it consists of extremely compact fibroid connective tissue, which contains few elastic fibres, few fixed cellules of connective tissue, and is slightly infiltrated with cellules resembling migrative cellules. This compact tissue is on the inner surface everywhere considerably infiltrated with red blood corpuscles, and rather more than on the outside, with cellules resembling lymph cells; lastly, the inner

surface of the membrane is covered by a rather thin, hard clot of blood." The examination, therefore, throws no light on the origin of the aneurism. It might be one of the cysts to be found in the neck. Cysts of the neck are divided by König in an excellent chapter of his handbook<sup>5</sup> into multi-lobular and uni-lobular. Passing over the first group (the so-called lymphangioma cysticum colli), we find in the second, to which, judging from the descriptions of patient and doctor, the cyst in our case might belong, first, cysts arising from branchial fissures (Kiemenspalten), serous cysts and deep *atheromata*, and bloody cysts (Hæmatocele colli). Most probably this was a cystis serosa arising from branchial fissure; these cysts have three favorite seats in the neck; the parts between the processes mastoideus and the os hyoideum—the parts on the inner margin of the sterno-cleido-mastoidei muscle, and lastly, the fossa supraclavicularis. The cyst in our case was situated in one of the two first-mentioned parts. One might reasonably make the objection that the cyst had made its appearance rather late in life, not until the fortieth year, but it is very probable that it may have been forming long before the patient became aware of it.

In the classification of aneurisms, by Broca, we find the following sub-division: *aneurisme cystogenique*; these are to represent aneurisms arising from a cyst which had originated in the thickness of the wall of the vessel and then come into communication with the lumen of the artery. Holmes<sup>6</sup>, who mentions this, adds at the same time that this species has not been acknowledged in any other classification. In none of the works to which I have had access have I found any mention of aneurisms arising from cysts, while there are cases known of an aneurism being formed by the opening of an abscess into the lumen of an artery, with the walls of which it was directly connected. Liston's case of this kind is well known, and Lefort<sup>7</sup> mentions several other ones referring to the arteria carotis communis and the carotis internal. Holmes<sup>8</sup> mentions

<sup>5</sup>Lehrbuch der speciellen Chirurgie, 1885. iii. T., p. 539.

<sup>6</sup>L. c., p. 412.

<sup>7</sup>Article "Carotide," L. c., p. 675.

<sup>8</sup>L. c., p. 421.

that Dixon has described an interesting case of hæmorrhage of the subclavian artery, which had arisen in consequence of the suppuration of the wall of a hydatid cyst which had been incised. All this, however, has no reference to the matter engaging our attention.

In a chapter on this subject, Broca<sup>9</sup> says: Stenzel and then Corvisart first drew attention to the existence of cysts, contained in the thickness of arterial walls; Leudet presented a curious specimen of a spleen in which there were three cysts: one not communicating with the artery, the other opening into it by two small apertures, the third, lastly, connected with the artery by an opening which equalled the diameter of the aneurism itself. Aneurisms caused by cysts should therefore arise in this manner: the cyst with its compact, hard, as if cartilaginous or encrusted walls, containing a fatty or atheromatous mass, arises in the thickness of the arterial wall and spreads in it in the shape of a semicircular tumor, always of inconsiderable dimensions, varying according to the size of the artery which has been attacked. Such a cyst may open into the lumen of the artery in this manner: first, there arises a hair-like opening, which gradually widens till, at last, the wall separating the lumen of the artery from the cavity of the cyst disappears altogether. The above explanation has not been received without serious objections. Already Hodgson (1819) justly remarks that some aneurisms, healed by the deposit of coagululum on the walls, with preservation of the lumen of the vessel, may give rise to tumors simulating the above-mentioned arterial cysts; in his opinion one must in this manner explain the facts recorded by Corvisart; according to him, therefore, arterial cysts, instead of being the starting point of aneurisms, are rather their consequence. After all this Broca concludes that arterial cysts are most frequently healed aneurisms, but that there are cases, although not numerous, which indicate that there may be original cysts which may subsequently open into the vessel and become the starting point of a very rare kind of aneurism. Eppinger, in his extensive monograph,

<sup>9</sup>*Des aneurysmes*, p. 11.

does not with a single word mention this cause of aneurism.<sup>10</sup> Our observations seem to give every reason to suppose that the cyst became the starting point of the aneurism, but we must admit that we can not make this affirmation with desirable certainty.

The method adopted by me, although it may be classed among the old methods, differs in an essential point from the so-called Method of Antyllus<sup>11</sup> (old operation, *méthode ancienne*), which consists in this: That ligatures are passed in under the artery from both sides of the aneurism, the vessel ligatured and then the sac opened.

Modern authors mention a modification of this kind; instead of ligating the artery, pressure is exercised between the aneurism and the heart on the trunk which conducts the blood into the sac, by means of the finger tourniquet, or best of all when it is possible the bandage of Esmarch. The sac is then opened, the coagulum scraped out, the opening for ingress and egress of the sac into the artery is sought for, ligatured, and the wound healed. (Lefort, p. 570; Follin-Duplay, p. 317; T. Holmes, p. 456.) This method of operation was generally applied to the smaller arteries, and all aneurisms, excepting those of the neck, groin and axilla. Although this method may from its description seem very simple, in practice it is indescribably difficult, in cases where the aneurism is deeply situated, or when the artery joins the sac from the deep side, or when the sac has many convexities.

Besides the difficulties in the performance, this operation, in pre-Listerian and especially in more distant times, belonged to the most serious, for this reason, that there often remained an enormous cavity in which suppuration took place and often spread, leading to thrombosis of the veins, to phlegmon, to subsequent hæmorrhages, to pyæmia, etc.

<sup>10</sup>Pathogenesis de Aneurysmen einschliesslich des Aneurysmen equi verminosum. Archiv für klin. Chir. T., xxxv.

<sup>11</sup>Generally, in the Handbooks it is called the Method of Antyllus, although as Lefort justly remarks, there is not the slightest proof that the Greek had first invented it, as his works have not come down to us; only in the work of Oribasius, discovered in Rome, 1831, by Angelin Mai, there is a chapter which contains the most distant traces of this operation, but Antyllus may have taken it from other still more ancient works of his predecessors, which have been lost.

The necessity of being secure from hæmorrhage during the operation, either by means of ligature or pressure of the artery between the aneurism and the heart, seemed to exclude from the old method all aneurisms of the carotid, subclavian, and iliac arteries, and even those of the femoral artery which are situated at its origin. And, really, how could one have the courage to open the sac at the risk of the patient dying of hæmorrhage under the eyes of the operator, when there were no means of averting the hæmorrhage?

O. Weber (p. 205), in his remarks on the various methods, considers that of Antyllus the most dangerous, and says that, owing to the suppurations of the sac, aneurisms on the neck, parts near the groin, and in the axilla, should not be operated at all, according to this method. Broca<sup>12</sup> mentions a certain Morel, surgeon of the Charité in Paris, who, at the close of the 17th century, endeavored in this manner to cure an aneurism of the carotid artery; the patient died of hæmorrhage during the operation. And so, this operation, which even formerly, was in general extremely rare, has fallen into complete disuse, since the memorable operation of ligature of the artery above the aneurism, performed in 1785, by the great Hunter, whose name it now bears.<sup>13</sup>

What, however, can a surgeon do, if, beside the aneurism, either of the axilla or groin, and especially the neck, there is no room either for pressure or ligature, while death from gangrene of the sac and skin, with subsequent hæmorrhage, threatens the patient? Is he passively to await the decease of his patient, since none of the methods of curing aneurisms (pressure, electro-puncture, etc.), can be put into practice, and, as in our case, owing to the spreading of the tumor to the processus mastoideus and the jaw, even the method of Brasdor-

<sup>12</sup>Des aneurysmes, p. 214.

<sup>13</sup>In manuals and periodicals, especially French ones, this method is often called the Method of Anel or Anel-Hunter. Not to speak of the articles of Englishmen, such as Hart and Holmes, who might be suspected of being biassed, it is enough to read the interesting, exhaustive and highly critical work of Lefort to see the services of Anel reduced to those of ordinary observation without consequences; all the honor is due to Hunter, who gave a new impulse to the operation; it was only then that literary researches brought to light the long-forgotten Anel.

Wardrop becomes impossible? I think that to this question the answer must be in the negative, especially now, when antiseptic treatment allows us to attain in surgery almost the impossible.

But even in former times there was found in the nation which has produced Abernethy, Pott, the Coopers, the Hunters, Bell, Brodie, Liston, Fergusson, Lister, Spencer Wells, and many others, a surgeon, Syme, who had recourse to the operation of opening the aneurism, with subsequent ligation of the arteries, and was fortunate enough to save the life of his patient. These cases belong to the greatest *curiosa* of surgery, and in support of my observations, I take the liberty of describing them.

OBSERVATION 1.—David Craik had a traumatic aneurism on the left carotid artery, which had arisen seven weeks previous, in consequence of the stab of a dagger, in the neck. This aneurism increased rapidly, notwithstanding the exercise of pressure. Although the tumor was of the size of an orange and did not reach the clavicle, Syme did not consider it easy or even possible to find the artery, in order to ligature it after the method of Hunter. He, therefore, first made a small opening in the sac with a knife, passed in a finger which obstructed the opening which had been made, then, with the tip of the finger he felt until he had found the point, the pressure of which caused the pulsation to cease. He then pressed on this point with great force, laid open the sac and sponged out the coagulum. A smooth, serous surface, without the vestige of an artery or vein, now became apparent. Having cut through the skin and the external part of sternocleido-mastoidei muscle horizontally, he seized the opening through which the blood escaped, and which was pressed by the finger, with forceps, drew the vessel out toward the trachea, scraped it carefully with a knife, so that the wall of the artery could be seen distinctly, then ligatured it above the opening; in the same manner he passed in a ligature below and then could remove the finger without fear of hæmorrhage. The patient recovered. (Holmes, p. 580).

In 1860 Syme announced a second case cured in the same manner. This time it was aneurism of the axillary artery; the state of the patient was alarming owing to threatening gangrene, so that, at first, excision of the shoulder joint was spoken of. Syme, however, fearing great hæmorrhage, preferred to have recourse to the old method.

He thus describes the operation: After putting the patient under chloroform, I made an incision along the outer margin of the sterno-cleido-mastoidei muscle through the skin, platysma myoides and fascia, so that one could pass in a finger to the point where the subclavian artery appears from below the scalenus anticus muscle and lies on the first rib. Syme then opened the sack, but the violent gush of blood indicated that the artery had not been well pressed. While I obstructed the opening with the hand, Lister, who was assisting me, managed to master the artery by an inconsiderable motion of the finger, which he had passed in deep under the upper end of the tumor and through the coagulum which it contained. I then opened the cavity and with both hands scraped out nearly seven pounds of coagulated blood (this has been verified by weight). It now became evident that the axillary artery had been torn horizontally; as blood continued to escape from the inferior end, I first of all ligatured that, then I cut through the pectoralis minor muscle to the very clavicle, and holding the superior end of the artery between the fingers and thumb, I passed in an aneurism needle about half an inch above the opening of the artery, and ligatured it" (Holmes, p. 555). In this case the extraordinary ascent of the clavicle, caused by the great overflow of blood in the axilla, on one hand facilitated the getting at and ligaturing the artery from below, and on the other hand, made it so difficult of access from above. Owing to the great depth in which the third part of the subclavian artery was situated, it became necessary to make an incision through the deep fascia of the neck before efficient pressure of the vessel could be effected. The patient recovered in the course of six weeks. On the strength of this case, Syme endeavored to prove that in treatment of aneurisms of the axilla, the preference is, in general, if not always, to be accorded to the old method rather than that of Hunter. Follin and Duplay share the same opinion, especially as to traumatic aneurisms of the axilla, in which inflammation of the sac is to be feared, and in which after ligature of the subclavian artery there remains a large sac which is disposed to suppurate.

It is difficult to believe, say Follin and Duplay, that the old method could be applied in cases of iliac aneurisms, and, yet, Syme by this method attained the cure of an enormous aneurism of that part. This aneurism spread downward below Poupart's ligament; upward, above the umbilicus; to the right, two inches beyond the linea alba, and in front it projected as much as the crista ossis ilei. The patient was a sailor. æt. 31, and the aneurism had probably formed in consequence of a knock in the groin in Nov., 1861. On April 20, 1862, Syme, after

having put the patient under chloroform, first tried to find the communis iliac artery, and not having succeeded in this, applied the screw-clamp to the abdominal aorta, in order to avert hæmorrhage. Having convinced himself that circulation had been stopped absolutely, he made an incision through all the tissues, opened up the sac entirely and removed about six pounds of blood and coagulum. The artery joined the sac at the very apex, having been lifted up by the blood amassed beneath it. He then with the utmost accuracy sought out the opening of the artery into the sac and ligatured the artery above and below the opening. After the ligatures had been put on it was remarked that the blood continued to escape from the opening, though with diminished force. From which Syme inferred that the iliac internal artery originated in the space between the two ligatures. He, theretore, uncovered the internal iliac artery and ligatured it. Thus, the communis iliac artery, the external iliac artery and the internal artery were each ligatured in turn. On the 19th, the ligatures came away, the cavity gradually filled, and the patient recovered. (p. 469)

Having described this case, Lefort adds: "L'exemple de Syme ne saurait être suivi. L'illustre opérateur, dont l'habileté égale la hardiesse, a été heureux dans ses tentatives; mais ce qui est permis à de chirurgiens d'une adresse opératoire et d'une expérience absolument exceptionnelles, ne saurait être conseillé comme règle générale, alors qu'une hésitation de quelques secondes peut amener la mort de l'opéré sous les yeux et entre les mains d'un chirurgien trop confiant en son habileté." (p. 574). Holmes thus expresses himself: "It is clear that such an operation as this can be successfully performed; (that is to say, performed without instant death resulting) only by a surgeon who possesses a large share of the fertility of resource and dexterity in operating, which Mr. Syme showed in so great a degree in this case." (p. 580).

As regards the two last cases in particular, Syme was more fortunate than I in this respect that he could, during the operation, effect pressure on the artery above the aneurism, and besides, he had the choice between the method which he adopted and that of Brasdor-Wardrop, while in my case, the want of room made it impossible to ligature the artery below the tumor (on the distal of the aneurism) or to exercise pressure above it.

The first who successfully applied the old method to aneurism of the carotid artery, was, according to Lefort, Sisco, who in 1829 performed the operation on a patient, æt. 17, Francesco Nasoni; the aneurism had arisen in consequence of a stab in the neck with a knife,

several days prior to the operation. Owing to the want of particulars we can draw no conclusions from this case.

OBSERVATION 3.—In 1829, a surgeon of Leeds, who does not give his name in full, only the initial H, published another case<sup>14</sup> “John Pratt, æt. 43, residing near Bradford, was admitted under Mr. H., on March 13, for an aneurism, the result of a wound inflicted on himself by a sharp pointed shoemaker’s knife. The injury had been done 10 weeks before his admission: lost at the time a large quantity of blood which ceased to flow as soon as syncope supervened. He gradually rallied and a pulsating tumor made its appearance, situated over the carotid artery, opposite the space between the os hyoides and the thyroid cartilage. The tumor represents a cone (*e. g.*, the transverse section of a common egg) the base of which may be said to include the artery, and the apex to point outward, on which is a small granulating wound, filled with coagulum. Hæmorrhage to an alarming extent has taken place every ten days or fortnight, but has always ceased on the occurrence of syncope. The above account was given by his son who accompanied him on his admission. Countenance pale, makes little or no complaint; indeed, appears in other respects to ail nothing. It was deemed necessary, on consultation, to secure the artery, which was done the following day at 2 o’clock P.M., by Mr. H. In the first place the common carotid was cut down upon and tied with a strong double ligature, in the usual manner, and without any difficulty whatever, the aneurismal tumor being situated so high above as not to interfere with the necessary incision of the operation. No impediment arose from the jugular vein. The next step was to open the sac, which Mr. H. did, by cutting freely from below upward, and removed the coagulum; the wounded artery being then exposed a copious flow of blood took place. This, together with the circumstance of the vessel being deeply situated, and the risk there was of wounding contiguous parts of an important nature, occasioned considerable difficulty and delay in securing the artery.

In opening the upper part of the sac, the superior thyroid branch was divided and immediately tied. Shortly after the punctured wound of the carotid artery was discovered, around which a double ligature was carried, both above and below, by which means a stop was put to all further hæmorrhage. From the size of the vessel (which was somewhat thickened by the adhesion and condensation of the cellular

<sup>14</sup>London Medical Gazette, 1829, vol. 1, p. 821. For the copy of this and another observation from the original in the library of the Medical School in Paris, I am indebted to Mr. S. Labororowski, student of medicine.

membrane), as well as from the situation of the puncture (*viz.*, opposite the upper edge of the thyroid cartilage), it was judged to be the external carotid that had been wounded about its origin.

The integuments were brought in contact with adhesive plaster, a flannel roller applied, and the patient removed to bed.

6 P.M. Complained of heat about his head, with pain and heaviness. Pulse moderate; had a purgative enema and a dose of *infus sennæ* administered, and repeated every few hours until free evacuations were produced. The spirit wash was kept applied to his head, and nothing, of course, but the mildest diluents allowed.

10 P.M. Had an evacuation by stool, and felt the symptoms relieved. He now commenced taking the effervescing saline draught, with 10 grains of the nitrate of potash, and by continued application of cold to his head, and attention to his bowels, all urgent symptoms went off in a few days. On the fourth day from the operation the ligature from the superior thyroid came away with the dressing; on the sixth, that from the external carotid in the same manner; and on the twenty-third that from the common carotid separated of itself. The dressings were removed on the second day. Wound was quite free of inflammation, and had in a great measure united by first intention. It was dressed daily afterwards with adhesive plaster. In the course of ten days, the middle half was cicatrized, and little remained but the sore occasioned by the presence of the common carotid ligature.

The discharge from first to last was very little, and inflammation not more than necessary for carrying on the adhesive process.

The patient was discharged, cured, April 16, being five weeks after the operation. Johnson Smith, in his article<sup>15</sup> on the carotid artery mentions that the old method was successfully adopted by the second Hey, in the shape of a traumatic aneurism of the carotid artery; it is very possible that this Mr. H., of Leeds, was identical with the second Hey.

OBSERVATION 4.—During the American war, Weir<sup>16</sup>, on September 30, 1862, acted in the same manner as Syme in the case of a diffuse traumatic aneurism, caused by a shot-wound in the neck; unfortunately the patient had, besides, sustained some injury to the spine, of which he died.

<sup>15</sup>Dictionary of Practical Surgery, by various British hospital surgeons, edited by Christopher Heath, London, 1887, p. 236.

<sup>16</sup>Medical and Surgical History of the War of the Rebellion. First surgical volume, pp. 456, 457.

September 30, 1862, I was summoned to a consultation in the case of Henry Herman, æt. 23, who, in the battle of Antietam, had been wounded in the right side of the neck, on the level of the superior part of the thyroid cartilage, and the anterior margin of the sterno cleido mastoidei muscle. There was little information to be gained as to the state of the patient prior to his admission to the hospital on September 24. On the 29th, twelve days after the injury had been sustained, slight hæmorrhage suddenly made its appearance. The bleeding was supposed to have been stopped by filling the small opening of the wound with lint, which had been saturated with liquor ferri sesquichloride. After this a pulsating tumor rapidly formed, and spread so violently that on the same day it extended from the jaw to the clavicle, and from the sterno-cleido-mastoidei muscle to the median line. Although the course of the ball was unknown, paralysis of the right leg and partial loss of motion in the right upper extremity supervened. In one hour after the consultation I was informed that the tumor had greatly enlarged, and had begun to press down the trachea toward the left. The skin covering said aneurism was tightly strained, pulsation and rough thrill could be felt on palpation. The stopping of lint was firmly fixed in the wound by coagulated blood. Respiration slow and abnormal, cyanosis of the face, pulse irregular, 65. It was determined to operate, supposing even that the spine were injured, as death from hæmorrhage was inevitable.

Having given accurate instructions to my assistants as to their parts in the operation, I took the lint out of the wound, and instantly widened it so far as to allow of two fingers being passed into the fundus of the cavity. I was fortunate enough to find and press down the opening of the artery, without great difficulty, and this effectually mastered the hæmorrhage which had been very violent, but of short duration. During the whole of this long operation we noticed that the bleeding from the artery was easily averted by very slight pressure. The coagulum was now scraped out and the incision lengthened, downward to the clavicle, and upward to the extent of an inch (the whole incision was; therefore, 3—4 inches long). The tissues being concealed by infiltration of blood, and displacement of parts in consequence of pressure, we experienced considerable difficulty in finding the artery, above and below the opening. It was only after long and repeated efforts that we found the central part of the artery and ligatured it with the aneurism needle of Mott. Meanwhile, the finger which was pressing down the opening of the artery, accidentally slipped off it, and the blood gushed out from the superior part of the

artery for 5 or 6 seconds. After the peripheral end had been ligatured, the hæmorrhage ceased entirely. While the first ligature was being put on, considerable disturbances in the respiratory ways were remarked, leading one to suppose that the *nervus vagus* had been caught in the ligature.

At the expiration of 10 or 15 minutes respiration became more regular. After six other ligatures had been put on we noticed hemiplegia of the left half of the body, and somnolence. The patient was, however, easily restored to consciousness; power of motion was retained only by the right upper extremity; deglutition was not disturbed. The opening in the artery was oval and a quarter of an inch long. The patient lost only eight ounces of blood, very little in so formidable an operation, which had lasted above two hours." From the remainder of the description, I only extract that the patient died on October 1, with symptoms of ever-increasing debility. At the post-mortem examination it was found that neither the inner jugular vein nor the *pervus vagus* had been caught in the ligature. Examination of the artery proved that the ligature had been carried three fourths of an inch above and three eighths of an inch below the wound, but the upper ligature had become rather loosened. The wound in the sheath of the vessels was one-eighth of an inch below the division of the artery; the wall of the artery seemed healthy, with the exception of the parts nearest the wound. The ball had struck the vertebral column from the front on the inferior edge of the sixth cervical vertebra, just inward from the vertebral artery which was unhurt—and had then penetrated into the spine.

OBSERVATION 5.—George E. Frothingham, Professor of Ophthalmology in Michigan, was more fortunate.<sup>17</sup>

On the night of August 16, 1875, H. O., æt. 23, was injured by the explosion of some powder kept in a store, which he and others were attempting to save from burning. At the time of the explosion he was standing in front of the show-window, and together with some of his companions, was thrown several feet toward the center of the street, and was for a moment rendered insensible. I was called to see the patient about an hour after the injury and found him suffering great depression, fainting at the least attempt at a sitting posture. His face was covered by scratches, caused by pieces of glass and other solid particles thrown in every direction by the exploding powder. Among

<sup>17</sup>A case of traumatic aneurism of right common carotid; operation of opening of the sac; internal jugular vein being wounded is also ligated, recovery.—*American Journal of Medical Sciences*, October, 1876.

his injuries were two penetrating wounds of the right side of the neck, one near the anterior-inferior angle of the suboccipital triangle, and the other just at the apex of the inferior carotid triangle.

The openings in the integument had the appearance of having been cut by some particles of glass and were between one and two lines in length. The external hæmorrhage had ceased soon after the injury, but a diffuse aneurism had been formed, extending from the angle of the jaw to the clavicle and pressing the trachea slightly to the left, and interfering with deglutition. An examination with a probe showed that the fragment that had entered at the upper opening had glanced upward and probably lodged in the tissue behind the external ear, though it could not then be felt.

The probe could not be made to follow the lower wound. The voice of the patient was reduced to a mere whisper. Rest in the recumbent position was enjoined; the right eye, which had been wounded, was attended to, and the symptoms carefully watched, the attendant being instructed to call me immediately should the tumor in the neck enlarge or the difficulty of swallowing increase. By morning, deglutition could be performed with less difficulty, and the tumefaction of the neck showed no tendency to increase. I was thus encouraged to pursue the expectant plan, hoping that the main artery was not wounded, but that the effused blood had been poured out from a wound of some of its branches, and a spontaneous cure might be possible. By the fourth day, however, the bruit became more distinct, and indicated very clearly that the artery wounded was the common carotid. From this time until August 31, the tumor became more circumscribed, projecting more just over the point where the artery was wounded, and leaving a slight depression between it and the clavicle. During this interval the weather had been comfortable, and the condition of the patient somewhat improved, he being able to sit up for a few moments without the marked symptoms of syncope that at first prevented this posture. The weather now became warmer, and by Sept. 3, the tumor showed a decided increase in size, and kept steadily enlarging. By the 6th, it became painful, and on the 8th, it was extremely painful, the patient requiring large doses of morphia to procure rest. The tumor now extended from the angle of the jaw to the clavicle, pressing the trachea well over to the left and projecting full two inches beyond the ordinary level of the neck. A slight depression or groove existed between the tumor and the clavicle. The symptoms being thus urgent, I decided to delay no longer, but operated Sept. 9, twenty-three days after the injury. The operation was

commenced at 3 P.M. The patient having been put under the influence of ether, the sternal and inner half of the clavicular attachment of the sterno-cleido-mastoid muscle were divided together with skin and fascia covering it. An incision was then made through the skin and deep fascia at the lower portion of the neck, just at the inner border of the sterno-mastoid, and a trusty assistant was directed to compress with his thumb the lower portion of the common carotid. In exercising the necessary pressure, the thumb broke through the thinned wall of the sac, but was brought immediately upon the artery, compressing completely its lower portion and with the effect to very greatly lessen the pulsation in the tumor. A narrow incision was now made through the most prominent portion of the tumor, the forefinger of the left hand plunged in, and the wound in the artery looked for. After a little search this was found and compression exercised, so as to completely stop the pulsation in the tumor. The sac was then laid freely open, the clots turned out, the cavity sponged, and the wound was now found to be in the common carotid artery, just below the lower border of the omo-hyoid muscle. The muscle was drawn upward and upon examining the posterior wall of the sac, the tissues of which were much altered in appearance, a considerable vein was seen to cross the artery at this point and enter the internal jugular, which, as is usual in such cases, almost completely overlapped the artery. In attempting to draw it to one side, its walls, probably softened by inflammatory action, gave way, and a fearful gush of venous blood was the result. This was instantaneously checked and controlled by pressure. A ligature was now thrown about the artery above and one below the wound. The internal jugular was next ligatured above and below the point of injury and the vein entering it here had also to be ligatured, making five ligatures in all. The wound was well cleansed, its edges brought together by sutures, the ligatures brought out near the inferior angle, a compress was applied, and the patient placed in bed. "Progress in general was good, without cerebral disturbances, and a certain rise in temperature. On the 21st day the ligatures came away from the arteries, and on the 29th from the vein. Restoration to health and strength complete. In describing this case the author says that he has found only one similar, that of Syme. This has already been quoted above.

OBSERVATION 6.—The latest case which I have succeeded in finding out is announced by H. Morris<sup>18</sup>. It differs considerably from the

<sup>18</sup>A case of aneurism of the external carotid, in which, after failure of the ligature of the common carotid, the old operation was performed successfully. *British Medical Journal*, 1880, vol. ii, p. 705.

others both as to its nature and technical difficulties as well as the mode of operation. The patient was a woman, æt. 45, and the tumor, of the size of a walnut, was situated at the level of the division of the common carotid artery. It was said to have arisen eight months before. The common carotid was ligatured with catgut at the point of election. Pulsation of the sac recommenced four and a half hours after the operation, and went on for a month. It then disappeared, but pulsation could still be felt in the external carotid artery. Six months later a non-pulsating tumefaction appeared below the angle of the jaw, accompanied by the former symptoms (pain in the head and neck, dryness in the throat and difficulty in swallowing); as after four weeks the symptoms seemed to indicate the presence of pus an incision was made through which some pus escaped; the unhealed wound began to bleed, and, half a year after the first operation, the aneurismal sac burst, causing fearful straining of the integuments. Then Morris ligatured the facial and the superior thyroid arteries, cut through the sac, removed the coagulum, and having convinced himself that the blood flowed out of the peripheric end of the sac, sought out the artery and ligatured it. Examination evinced that all the blood did not flow into the sac from the carotis interna, and that the clot did not lengthen out into its lumen. The author on the strength of these observations concludes that after ligature of the common carotid artery the blood does not get into the inferior end of carotis internal artery, and that, therefore, in similar cases not only the carotis common but also the branches of the carotis external artery should at the same time be ligatured, to avoid the flow of blood into the sac.

These seven cases, some given in summary and some in extenso, represent the whole of the material which I have been able to find in the literature accessible to me. The most important points are given in the accompanying table.

The most striking circumstance in these cases is the fact, that, in spite of the importance of the operation, nearly all those who were operated upon recovered. With the exception of the case of Morel, which happened so long ago, we have, of seven cases, six of recovery. Even in the case of Weir, death did not result from the operation, but from the injury done at the time to the spine. The methods adopted by the surgeons (putting aside the cases of Morel and Sisco, about which we have but scanty particulars) were not alto-

<i>Number</i>	<i>Name of Surgeon.</i>	<i>Date of Ligature</i>	<i>Name of Patient.</i>	<i>Remarks.</i>	<i>Result.</i>	<i>Source.</i>
1	Morel, Surgeon of the Charite, Paris.	Close of 17th century.		Absence of particulars.	Death of hæmorrhage.	Broca, "Aneurysmes," page 214.
2	Sisco.	1829.	Fran Naso- ni, æt. 17.	An. traumaticum in consequence of a wound inflicted by a knife several days previously.	Recovery.	Bulletin de Ferrussac. After Lefort.
3	Leeds, (probably Hey).	1829.	John Pratt, æt. 43.	An. traumaticum since 10 weeks. First artery was ligated below aneurism; opening of sac; then periphene ligature.	Recovery.	London Med. Gazette, 1829, vol. i, p. 821.
4	Syme. Edinburgh.	1859.	David Craig	An. traum. car. sin. after dagger wound, inflicted seven weeks previously. Operation by method of Syme.	Recovery.	Edinburgh Medical Journal, 1857, p. 105. After Holmes and Lefort.
5	Weir, America.	Sept. 30, 1862.	Soldier, æt. 23.	Shot in the neck on Sept. 17. An. traum. diffused. Operation by Syme's method.	Death owing to simultaneous injury of the spine.	Medical and Surgical History of the Ar. I Surg. Vol., pp. 456-457.
6	Frothingham, America.	1876.	H. O., æt. 33.	An. traumat. since 34 days after explosion. Digital compression at origin of artery. Opening of sac to admit a finger; pressure of wound.	Recovery.	American Journal of Medical Sciences, 1876 October.
7	H. Morris. London.	1880.	Woman, æt. 45.	Bursting of aneur. sac after ligature of com. carotid artery.	Recovery.	British Medical Journal, 1880, vol. ii, p. 705.
8	Matlakowski, Warsaw.	April 24, 1887.	Chrusci- kawska, F., æt. 47.	An. traum. car. dextra after cauterization of cyst contiguous to artery, with ligature 4 week after formation of aneurism	Recovery.	"Gazeta Lekarska," Medical Gaz., year 1888, Nos. 6, 7, 8, 9.

gether alike. Hey, first of all, ligatured the common carotid artery between the aneurism and the heart. Morris, in proceeding to open the sac, found the artery already ligatured after the first operation. Frothingham purposely made an opening in the lower part of the neck, and from thence exercised pressure on the vessel before he proceeded to open the sac. Syme and Weir, not having space enough for a similar manipulation, endeavored to diminish the danger of hæmorrhage by opening the sac sufficiently to admit two fingers, thus serving the two purposes, first, of finding the wound in the artery, and of obstructing the opening of the sac. As to my case, being of the opinion that only the very rapid getting at the opening of the artery made it possible to diminish the frightful hæmorrhage, I made a free incision without any introductory manipulation.

Of course the conduct of the surgeon must be influenced by the individual circumstances of the given case. Theoretically, the common carotid artery should, first of all, be ligatured peripherically, and only in those cases where it is impossible to do so, the modification proposed by Syme adopted.

On the strength of the above cases we come to the conclusion, about which there cannot be any doubt, that, *in cases of traumatic aneurisms of the neck, the only sure method worthy of modern surgery is, ligature of the vessel on both sides of the wound in the artery, and simultaneous opening of the sac.* All other methods, such as pressure with all its variations, galvanopuncture, injection of blood-coagulating remedies, and so on, though they might even, in some cases, show good results, must be set aside as uncertain, often dangerous, always exposing the patient to delay and thus diminishing the favorable chances of the principal operation.

The method of Antyllus agrees with the fundamental principle accepted by surgeons only as to the stoppage of arterial hæmorrhages in general. This has been emphatically formulated in modern times by Maunder<sup>19</sup> and Ed. Rose<sup>20</sup> thus:

<sup>19</sup>Leitsomian lectures on the surgery of the arteries. The Lancet, 1875, summarized in Virchow's Jahresbericht.

<sup>20</sup>Ueber Stichwunden der Oberschenkelgefäße und ihre sicherste Behandlung. Sammlung klin. Vorträge, Nos. 89-92.

That the ends of the bleeding vessel be ligatured at the very point of the injury; besides which the latter advises excision of a part of the artery for the purpose of being perfectly certain that no branch departs from the space between the ligatures. Lefort<sup>21</sup> also, in an article often quoted by us, says distinctly: "la ligature des deux bouts isolés de l'artère, a l'endroit même on elle a été blessée, est le traitement le plus rationnel." It would be superfluous to multiply quotations on this subject which is the alphabet of surgery. One should, however, be imbued with this principle also as regards aneurisms. Nevertheless we hear of frequent cases indicative of the surprising fact that this fundamental principle is not taken into consideration, or is put into practice too late; after other humbugging but more easy methods have been tried, to the injury of the patient.

*The second indication, besides traumatic aneurisms, is the rupture of aneurisms treated according to other methods.* Among the cases which we have mentioned, that of Morris belongs to this category. Lefort mentions three other cases of hæmorrhage after rupture of the sac.<sup>22</sup> In these three cases one proceeded to ligature the common carotid artery; in two of them there were subsequent hæmorrhages; the patient of Nicoli recovered (*Gazette Med.*, 1851, p. 570); the patient of Scriven died of recurring hæmorrhages (*The Medical Press*, 1865, p. 563); and lastly, the patient of Robertson, after bursting of the sac, had hæmorrhage into the cavity of the mouth; the common carotid artery being ligatured, he recovered (*American Journal*, 1838, vol. xxii. p. 221).

We see, therefore, that the above rule as to carotid arteries was observed only once; in the other cases the operators restricted themselves to simple ligature of the vessel, centrally from the aneurism. Even in cases of the deeply situated internal carotid artery the method above recommended gives good results, as the following two observations testify: In the case of an S-like wound below the left angle of the jaw there was fearful hæmorrhage; Lee seeks out the central end of the internal carotid artery (while the common carotid artery is

<sup>21</sup>Dictionnaire "Carotide," p. 62r.

<sup>22</sup>Loc. cit., p. 624.

being pressed) and ligatures it in the wound; as soon, however, as pressure is removed from the common carotid, renewed hæmorrhage from the peripheral end, which Lee also ligatures; recovery.<sup>23</sup> During the discussions referring to the case of Prewitt, Wm. Briggs relates the following case: A young man with aneurism in the neck presented himself five weeks after having been wounded; at first it was supposed that one of the branches of the external carotid artery had been injured, but at the operation it appeared that it was the internal carotid artery which had been hurt. The sac was opened, the opening in the artery obstructed by a finger, the artery then ligatured above and below the wound; recovery.<sup>24</sup>

The case of Prewitt also, though ending in death, does not oppose the rule above given. In this case, that of a youth, æt. 17, an aneurism of the internal carotid artery had arisen in consequence of a shot wound on the level of the foramen caroticum; three months after the injury there was a distinct tumor in the pharynx. A ligature was carried about the common carotid artery, but pulsation commenced after a few months. Prewitt decided on opening the sac and ligaturing the peripheral end; it then became evident that the sac extended to the base of the skull, to which it adhered, so that the artery could not be got at from that side. Prewitt therefore delayed the operation; applied a drain and dressing. On the eighth day there was hæmorrhage; then a tampon of iodoform lint was used. The patient died twenty-five days after the operation from exhaustion.<sup>25</sup> The danger of pressure on the neck is proved by a case related by Vander Veer, in which, on pressure being occasioned for the third time, the patient suddenly expired, probably from epilepsy. For this reason Ford Thompson recommends the treatment of aneurism of the internal carotid artery, opening of the sac and ligaturing

<sup>23</sup>Double ligation of the internal carotid artery, 1869, by Lee. *American Journal of Medical Sciences*. January. Summary in Virchow's *Tahresbericht* for the year 1879.

<sup>24</sup>*Revue des Sciences Médicales*, 1886, vol. xxviii, f. 2, p. 611; (summary from the *Trans. Amer. Surg. Assoc.*, vol. iv, 1886).

<sup>25</sup>*Idem*.

both ends; in case of want of room he counsels cutting through the ascending branch of the jaw.<sup>26</sup>

In general we, in modern times, more and more frequently meet with descriptions of cases treated according to the method of Antyllus, and its application is more and more frequently recommended. Paget, in finishing the description of his classical case, says of the method of Antyllus: "I have no doubt, that as more cases are brought under observation, the above method will find more frequent application. Taken generally, nothing can be urged against it except that one face the violent hæmorrhages, which must be rapidly put an end to. This method ought to be adopted in nearly all cases of rupture of the arteries."<sup>27</sup>

From this rule, Paget excepts ruptured aneurisms of the popliteal artery in which he advises ligation or amputation. Largeau<sup>28</sup> in a work, written in consequence of the splendid results of an operation according to the method of Antyllus performed by Blum on an aneurism of the popliteal artery, has gathered 25 cases, from which it appears that these aneurisms also, may be operated upon according to the method of Antyllus. In these records there is no mention of two cases, previously announced by Horoch,<sup>29</sup> successfully operated by Albert. In the opinion of Horoch: "In the treatment of small, circumscribed, newly formed and even in large circumscribed, old aneurisms, surrounded by strong walls, one may successfully try digital pressure, before proceeding to the radical operation, but in diffuse, newly formed aneurisms the only proper method seems to be that of Antyllus," "which is not more dangerous than any other important manipulation."<sup>30</sup>

<sup>26</sup>Revue des Sciences Medicales. 1886, vol. xxviii.

<sup>27</sup>Aneurism in the femoral artery with rupture of the sac. Lancet, April 24, 1869.

<sup>28</sup>Du traitement des anéurysmes poplités par la Méthode d'Antyllus. Archives Generales de Médecine, 1885, p. 267.

<sup>29</sup>Ueber die Behandlung der Aneurysmen nach der Methode des Antyllus. Allg. Wiener Med. Zeitung. 1883. Nos. 18 und 19.

<sup>30</sup>Weun wir nun kurz resumiren, so sind wir zum Schlusse der Ansicht; dass bei kleinen circumscribten frischen und vielleicht auch bei grossen abgeschlossenen und mit einer festen Wandung umgebenen alten Aneurysmen, ganz wohl die Digital-compression versucht werden kann, ehe man zur Radicaloperation schreitet, dass aber bei diffusen frisch entstandenen Aneurysmen einsig and allein die Methode nach Antyllus indicirt erscheint.

Largeau at the close of his work gives the following indications as to aneurisms of the popliteal artery. Ligature according to the old method is indicated: 1. In all traumatic aneurisms. 2. In diffuse aneurisms when rupture or suppuration is to be feared. 3. In circumscribed aneurisms, when pressure has failed, and then without delay, not waiting until they have attained a large size. The earlier the operation is performed the easier it is and has the more chances of success.<sup>31</sup>

As to aneurisms of the axillary artery, T. Holmes says that although Syme is wrong in putting the method of Antyllus above the ligature of Hunter, there are, nevertheless cases of injury to the axillary artery, and very rare cases of aneurisms of that vessel, in which the preference given to the method of Antyllus is fully justified, always however keeping in view the possibility of amputation. As to aneurisms of the carotid artery, he remarks that Syme's case leads to the question whether in aneurisma spontaneum it would not be advantageous to recommend the method of Antyllus in preference to simple ligature.<sup>32</sup>

Gueterbock in his summary of Scribe's work says: "The satisfactory progress of operations according to the method of Antyllus which has in modern times been observed rather than the doubtful result of statistics ought to rouse one to imitation."<sup>33</sup> P. Vogt while giving the highly unsatisfactory result, founded on the statistics of Wyeth, of ligature of vessels in aneurisms, expresses himself in favor of the same views.<sup>34</sup>

<sup>31</sup>La ligature par la Méthode ancienne est indiquée: 1st, dans tous les anéurysmes traumatiques; 2d, dans les anéurysmes diffus sur le point de s'ouvr en dehors ou suppurés; 3d, dans les anéurysmes circonscrits ou 'la compression aura échoué et cela sans attendre qu'ils prennent un très gros volume. (Loc. cit., p. 314.)

<sup>32</sup>Lectures on the surgical treatment of aneurism and its various forms. Lancel. 1872. Summarized in Virchow's Jahresbericht for 1873.

<sup>33</sup>Der gute Verlauf, den die alte Operation nach Antyllus neurdings mehrfach genommen dürfte eher zur Nachahmung auffordern, als die zweifelhaften Zahlenergebnisse. Virchow's Jahresbericht, y. 1885.

<sup>34</sup>Dass die Behandlung mit compression und Beihilfe dringend nahegelegt und für alle leichten wie Nothfälle von Ligaturen immer wieder die öetliche Doppel-ligatur, entweder bei Continuitätsligatur mit Durchschneidung des Gefässes zwischen beiden Ligaturen und bei Aneurysma mit Entleerung des Sackes der einfacher proximalen oder distalen Ligatur entschieden den Vorrang abgeroinet. Real-Encyclopädie. II Auflage. 1885. p. 490.

Richard Barwell in his newly-edited international surgery says of the method of Antyllus,<sup>35</sup> In certain cases it, to this day, gives the only means of saving the life of the patient, and if the latter escapes the exhaustion which may result from the process of healing, he is cured of his aneurism radically and definitely." This operation is indicated in all cases of wounds or rupture of the arteries which have been falsely called "aneurysma traumaticum diffusum;" after failure of ligature, and also in those cases in which after ligature and the exercise of bending or pressure the aneurismal sac has burst. Passing on to aneurisms in particular, he weakens his praise of the method of Antyllus (p. 621). Speaking of aneurisms of the axillary artery with reference to the case of Syme, he adds: "It is doubtful whether a saeciform aneurism of the first part of the axillary artery can be treated according to this method and even if this were possible, the mortality would probably be very great." "Syme's proposal of curing aneurisms of the groin and carotis in this manner, cannot be taken seriously." And further (p. 633). The old operation was lauded by Syme, in the treatment of carotid aneurisms, at the very beginning; but this vessel is anatomically unfavourably situated, it being very difficult, even impossible, to restrain circulation in it, and a surgeon reading Syme's description of his operation will have little wish to imitate him in this point; however, if the operation of Hunter has failed, and the aneurism increases, the old method may, with comparative facility, be adopted, as the ligature obstructs the artery sufficiently, and affords a certain degree of safety. Under these conditions the operation has been performed twice in America and lastly in London, by Morris."

In these opinions, which I have purposely quoted in extenso, we find certain contradictions, for there is no doubt that if the operation has given good results in the most desperate cases success ought to be still more certain in easier cases. In contradiction of what has been said by Barwell, it is always possible except when the aneurism extends to the very clavicle (as in Syme's case and in my own) to avoid hæmorrhage by

<sup>35</sup>Encyclopédie Internationale de Chirurgie, vol. iii, p. 563.

cutting through the sterno-cleido mastoid muscle. If it is possible in cases of struma to find and ligature the inferior thyroid artery, it is surely much easier in cases of large aneurisms to find the common carotid artery.

Taken generally the method of Antyllus has long been considered dangerous in cases of aneurism of the neck, axilla or groin, as also in very large aneurisms of other parts. The chief cause of danger has already been given by Oribasius; it consists in the unfavorable anatomical conditions, the situation of the tumor deep in among nerves and veins. In the course of time there was added the danger resulting from suppurative thrombosis of the veins, pyæmia, etc. This last danger has, however, now been removed; by strict aseptic treatment, *prima intentio* may with certainty be attained; even when the rigid walls of the sac do not after having been emptied fall together and approach each other by filling the sac with coagulum, healing without suppuration under a humid crust may be brought about.

As regards the difficulties resulting from the anatomical position the case is quite different. In that particular the greatest difficulties may arise. The most favorable position is that of aneurisms of the common carotid artery, the groin and thigh: that of aneurisms of the fossa poplitea is much worse, but the worst of all is the position of axillary aneurisms. As to the latter particularly it is extremely difficult to put into practice the method of Antyllus, for even after cutting through the pectoral muscle, there remains the close connection with the veins, and especially with the plexus brachialis which partly surrounds the artery. In our day of surgical triumphs, however, the surmounting of these anatomical difficulties cannot be considered an impossibility. Besides the inconvenient position of the aneurism with reference to the veins and nerves, as also the joints of the humerus and femur, great difficulties may be occasioned by the lateral arteries, which start from the sac itself.<sup>36</sup> These may, if not ligatured, become the source of

<sup>36</sup>Instance: Case of Davies Colley. Aneurism, traum. femorale below the apex of Scarpa's triangle; relapse after Hunter's operation performed by Saxtorph. Colley made the old operation, besides that, ligatured a lateral branch of the thickness of the radial artery opening into the sac.

recurring hæmorrhages, while to ligature them, especially those which start from the deep side of the tumor, is unutterably difficult. But for a good anatomist and calm operator even this difficulty is not insurmountable, as is proved by many cases of aneurism of the poplitea which have been successfully treated according to the method of Antyllus. In cases of extraordinary difficulty caused by a muscle or even nerve, when the life of the patient is endangered, cutting through and then suturing these, with the view of opening up the way, seems indicated. This proposal should cause no surprise, for many counsel the amputation of a limb for the purpose of saving the life of the patient.

We do not speak of gangrene, as that is to be feared in ligature of Hunter, pressure, and all other modes of treatment, alike. The superiority of the method of Antyllus to all other modes of ligature is very great and unquestionable. This operation is performed systematically, and not by chance; all the branches and both ends of the artery are ligatured, and thus the most chances given of escaping recurring hæmorrhages. Whoever imagines that the simple ligature of Hunter or Anel (in cases of wound or rupture of artery) gives safety from hæmorrhage, has never closely observed the course of events. Thus it was in my case, as also in one of Dr. Jawdynski's, who, for cancer overgrowing the jugular vessels, had ligatured the common carotid artery and then cut it through between the ligatures. The moment after the peripheric end of the artery was as much filled with blood as before the ligature. In another case, of excision of a sarcoma in the groin, after ligature of, first, the *iliacæ communis* artery, second, the *femoralis superficialis* artery, and third, the *femoralis profundæ* artery, when my colleague, Jawdynski, cut off a lateral branch which started from that part of the artery which was between the ligatures, the blood gushed out in a stream, with only this difference, that the stream was not pulsating, but uniform. Broca dedicates an important chapter of his fine work to the subject of the immediate return of blood into the sac after ligature.

The second great advantage of the old method over simple ligature is the removal of the sac, which was liable to burst or

suppurate, or cause relapses, as has been proved in literature, and of which many examples might be given. In very bad cases, the method of Antyllus was resorted to, but of course it had then much less chance of success than if it had been adopted at the very beginning. The further superiority of the method to simple ligature becomes evident to everyone in cases of anomalous division of the artery, in which pulsation or hæmorrhage have recommenced, notwithstanding ligature.<sup>37</sup>

In the opinion of Follin<sup>38</sup> the ligature of Anel ought to be altogether proscribed in the treatment of varicose aneurisms. What has already been said in favor of the old method with regard to traumatic aneurisms may be repeated as to venous aneurisms, which are also of traumatic origin. If all other remedies have failed, the only sure means of cure is ligature of the vessel above and below the opening in the artery, with or without opening of the sac, as has been tried by Norris and Malgaigne.

The old method has often been severely criticized because of its great difficulties; but on the other hand, it has not been taken into account that other apparently more innocent methods do not give any security from fatal accidents, whereof we find many cases in literature, while there are probably many more which have never been recorded. The consideration of these accidents would lead us too far; we therefore avoid it altogether.<sup>39</sup>

<sup>37</sup>Among many instances that of Terry; Traumatic aneurism of the radial artery of the size of a child's head in the middle of the antibrachium; the arteria brachialis was ligatured without effect; it was only upon strict examination that the cause of failure was found to consist in the high division of the brachial artery. Ligature of arteries for aneurism. *Lancet*, Feb. 3. Summary in Virchow's *Jahresbericht* for 1872.

<sup>38</sup>*Traité élémentaire de Pathologie externe*, vol. ii, p. 374.

<sup>39</sup>Here follow some examples from among many cases of ill-treatment of aneurism; instead of adoption of the straight road leading to good results:

I. Aneur. spont. poplit.; hyperflexio, compressio digitalis; sack with shot, tourniquet, twice injection of ferri ses-quichlor; then eight drops of tannini iodatis finally, embolia, gangraena cruris, septicæmia, and death. Verneuil, *Observations d'aneurysmes*. *Gaz. des hôpitaux*, Nos. 111-117.

II. An. diffusum. a. poplit. sin., hyperflexio, pressure by sac with shot, exudate to the knee-joint, inflammation of aneurism, inflammation of entire skin, status thyphoides, amputation of femur, septicæmia, death. (Verneuil; *ibidem*.)

III. Strong man, æt. 31. In Scarpa's triangle aneurism since five months; pres-

sure under tourniquet during fourteen days; murmur disappeared, but tumor still enlarging; extremity swelled; on the twenty-eighth day, mortification; exarticulatio femoris; death three hours afterward. (St. George's Hospital Reports, summary in Virchow's Jahresbericht for 1873).

IV. Patient æt. 58. Aneurism between both malleoli since three months. At first was taken for an abscess and the skin incised; instead of proceeding to operate, one delayed, on the fifth day the sac burst, hæmorrhage, lig. tib. an. just above the joint, but hæmorrhage ceased only after ligature of a. dorsalis pedis, just under the entrance into the spatium interosseum. In the evening of the same day renewed pulsation and murmur in the sac in consequence of the flow of blood through a lateral artery running horizontally near the outer malleolus; the tourniquet of Petit was applied to this small artery; development of new lateral branch on the tenth day between the tumor and tib. antica; suppuration of sac, filled with coagulum. (Panas. Aneurysme de l'artère pédieuse. Gaz. des hôpitaux, No. 57, y. 1873). The above instances might be easily multiplied.